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This review of the Kansas mineral resources should give us a higher opinion of our state. The record of the past is one in which we can well take pride, and it is to be hoped that this is but the beginning of greater things to come. New mills are now building, new deposits are now being uncovered, and progress is sure to follow.

THE FLINT HILLS OF KANSAS.

BY J. R. MEAD, WICHITA.

Read before the Academy December 28, 1900.

In this article I shall not attempt to give the geology of the Flint hills. I simply give my observations of years past in a general way.

The so-called "Flint hills" extend through the counties of Chase, Butler, Cowley, and the northwest part of Greenwood, and south through the Kaw reservation, where they merge into sandstone. Their summits are in range 8 east of the sixth principal meridian. North of the Cottonwood they appear to merge into the general line of the uplands. The same strata of rock probably extend northward through Morris and Wabaunsee counties. These hills are the culmination and eastern end of the Upper Carboniferons formation, which, rising toward the east on these hills, reach a general altitude of 1600 feet. In Butler county the eastern declivity is abrupt, and the many ravines descend sharply to the valley of Fall river. From Beaumont, on the summit, to the mouth of Fall river, a distance of fifty miles eastward, the fall is 800 feet. The Flint hills are the result of erosion and not an anticline. In the general wearing down of the various strata once overlying Kansas, nature here formed layers of hard, solid, silicified limestone, effectually stopping the further progress of erosion, as did the massive gypsum which caps the hills of Barber and Comanche counties. This wearing away continued on either side, until the valley of Fall river was formed on the east and the Walnut river to the west, leaving these hills high in the air; yet the approach from the west is so gradual and uniform it is hardly noticeable. A fine exposure of this limestone is found along the bluffs bordering the south fork of the Cottonwood on the east, where along the slopes of the ravines may be seen blocks of stone ten by fifteen to twenty feet, and eighteen to twenty inches in thickness, on which the tooth of time makes exceedingly small impression.

The name "Flint hills" is misleading. These hills, or high table-lands, gently sloping to the west, contain no strata or ledges of flint. The thin deposit of chert, styled flint, found on the surface of the summits of the hills in Butler county, is derived from nodules of that material occurring in the limestone rock of that locality, the superimposed layers having weathered away, leaving the indestructible flint nodules on the surface. These have broken into fragments by the action of the elements, fire being an active agent. In the Walnut river, above Arkansas City, are large beds of this broken flint, washed down from the hills and tributary streams in time of flood, in which are found many buffalo bones and skulls. Indian arrow points are often found along the railroad tracks, where this gravel is used for ballast.

In the Kaw reservation, on the summit of the hills are ancient quarries where some primitive people obtained flint nodules from which to make arrow-heads, spears, and knives. To the west there is no stone in Kansas or the territory suitable for that purpose.

There is no lead or zinc or other valuable metals in these hills, as many suppose, nor oil nor gas. If they were within the boundaries of a coveted Indian reservation they would contain all these, also abundance of gold and other desirable things, in the imagination of boomers and squatters.

There is a thin vein of coal of little value underlying these hills. On Coal creek, a tributary of Jacobs creek, ten miles southwest of Emporia, it was mined for neighborhood use thirty-five years ago. The same vein of coal is found in some of the streams or ravines coming out of the Flint hills on the west, tributary to Fall river, in Greenwood county. It is possible pockets of this coal may be found of value.

The soil of these hills is rich in lime and organic matter; affords abundant nutritious grasses; bleak in winter; and in summer affords the finest pasture for herds of cattle and sheep. Thus these hills contribute their share to the food supply of the nation.

FOSSIL PLANTS IN THE PERMIAN OF KANSAS.

BY E. H. SELLARDS, UNIVERSITY OF KANSAS, LAWRENCE.

Read before the Academy December 29, 1900.

The discussion of the age of the Upper Paleozoic of Kansas has rested heretofore on the evidence of animal fossils alone; but a little more than a year ago Mr. Charles Sterling, of the University of Kansas, found near his former home, in southwest Dickinson county, some well-preserved fossil plants, and brought a small box with him on his return to the university. They proved of much interest, and in the following October the author, under direction of the University Geological Survey, spent a week collecting at the locality; and again, during the past summer, was permitted to spend three weeks in the region, thus making a more complete collection. In August, 1900, I learned through Professor Jones, of Salina, that Mr. Charles Polleys had found some plants in the shales along the Smoky Hill river just east of Salina, and that Professor Jones had also obtained a few plants from the same shales. Later, I had opportunity of visiting this locality in company with Professor Jones.

The plants of both localities are very near the top of the highest Permian found in that region. The plant horizon of Dickinson county is separated by only about twenty feet of alternating thin layers of impure limestone and shales from the overlying Cretaceous sandstone. Below the plant stratum thin limestones and shales occur for a thickness of ten to fifteen feet, with a dark-blue shale below, apparently of considerable depth, the lower part of which is streaked with layers of gypsum and dolomite.

The first plants collected, those by Mr. Sterling, were obtained at the head of one of the west tributaries of Turkey creek, three and one-half miles south of Banner City. From this place I was able to trace the plant stratum a mile north, finding plants at various places. To the south I found many exposures for about two miles, and traces of plants again in Marion county, six miles south. The same stratum would probably be found along the hills near the top of the Permian through the northwestern part of Marion county. To the west the plant-bearing stratum dips under the Cretaceous, but is exposed wherever the streams cut deeply. On Holland creek, three miles south of Carlton, some good plants were obtained. The plant-bearing stratum is to be looked for in the deeper creeks as far west as Salina, and doubtless search throughout this region would discover some good localities for collecting.

Whether the shales at Salina are the same as the blue shales underlying the